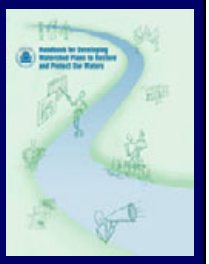
Watershed Based NPS Plans

An Integrated Approach to Water Resource Management in Indian Country

New EPA focus: watershed plans

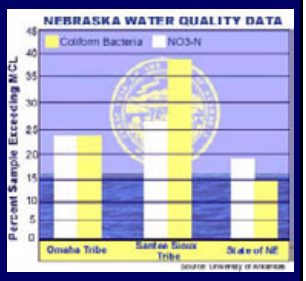
- "Best means for preventing and resolving NPS problems and threats"
- "Provide a coordinating framework for solving water quality problems"
- Provides "geographic focus... partnerships...strong science & data"
- Supports "priority setting and integrated solutions"



www.epa.gov/owow/nps/cwact.html

Watershed-Based NPS Planning

- Introduction and Background
- Basic Components of a Watershed-Based Plan
- TMDLs and Watershed-Based Plans
- Watershed-Based Plans to Protect Unimpaired Waters
- Relationship to Other Key Local, State, and Federal Programs



Introduction and background

- Continued focus on impaired waters
- Watershed plans to be developed first
- 319-funded work plans should be based on the overall watershed plan
- New focus on:
  - Quantitative analysis of current loadings
  - Estimates of pollutant load reductions needed
  - Load reduction potential of specific, planned BMPs
  - Phased implementation of the watershed plan

Watershed Management Cycle

Most watershed planning and implementation procedures follow a similar process

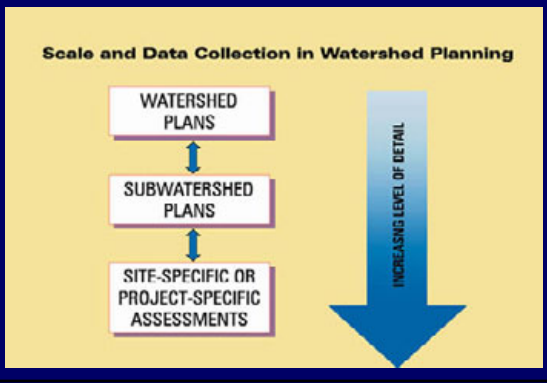
The EPA's nine elements of watershed-based NPS plans are incorporated into this process

Basic components of a watershed-based plan

- ID the watershed and stressors & sources to be controlled
- Estimate load reductions needed & expected from BMPs
- Describe mgmt measures & targeted critical areas
- Describe info & education needed to promote BMPs
- Develop schedule for implementation of BMPs, assign tasks
- Describe interim, measurable milestones
- Identify criteria to measure progress
- Develop monitoring component
- Estimate TA, $$, & sources required for implementation

Source: US EPA 2004 319 Supplemental Guidelines

Scale is a key issue



Phasing the approach

Start with "Big Picture"

- What do we know?
- Perceptions of watershed issues
- Preliminary goals and objectives

→

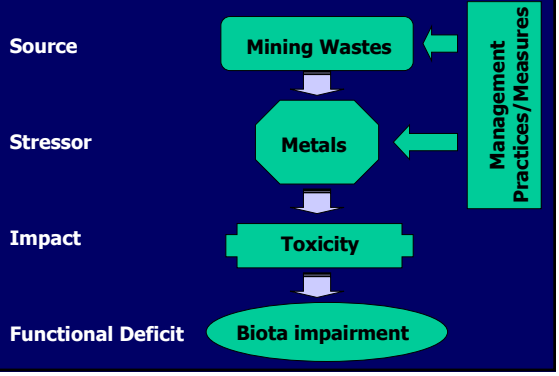
Work toward specifics

- Load reductions needed
- Targeted BMPs
- Implementation Strategy

Tools for Watershed Assessment and Management Strategies

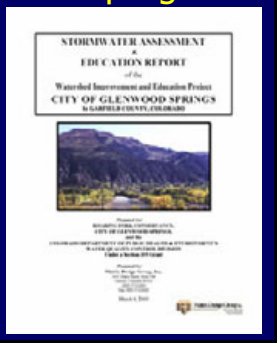
- Identify stressors & sources to be controlled
- Estimate load reductions expected or needed
- Describe NPS management measures & targeted critical areas

Simplified Conceptual Model

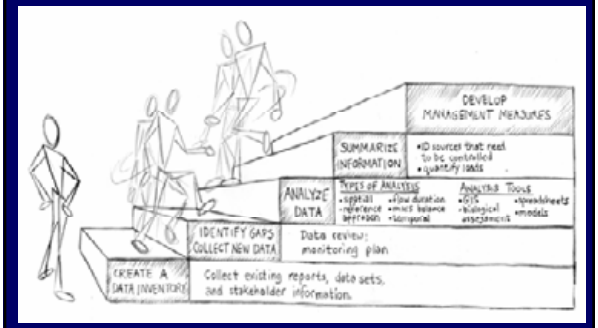


Coordinate with other water resource and land use programs

- Section 303, Water Quality Standards, TMDLs
- Section 319, NPS Program
- Section 402, NPDES Permits, CAFOs
- Source Water Protection Plans
- Wetlands Protection Programs
- EQIP, CRP, BLF, USFS, USFWS
- More…



Gathering and using data



Gathering data

- What types of data do you need?
  - Physical and natural features
  - Land use and population characteristics
  - Land management practices
  - Waterbody conditions/data
  - Pollutant sources
  - Other BMPs in use

Types of Data Needed for Watershed Characterization

- **Physical and Natural Features**
  - Watershed boundaries
  - Hydrology
  - Topography
  - Soils
  - Climate
  - Habitat
  - Wildlife
- **Land Use and Population Characteristics**
  - Land use and land cover
  - Existing management practices
  - Demographics
- **Waterbody Conditions**
  - Water quality standards
  - 305(b) report
  - 303(d) list
  - TMDL reports
  - Source Water Protection Areas
- **Pollutant Sources**
  - Point sources
  - Nonpoint sources
- **Waterbody Monitoring Data**
  - Water quality data
  - Flow data
  - Biological data
  - Instream habitat

Gathering data

- Build on earlier efforts
  - What has already been done?
  - Existing data sets and reports
    - Septic system inventories
    - 305(b) report
    - Wetland inventories
    - Source water protection plans
    - Forest and rangeland management plans
- Who has the data?
  - Tribal nations
  - Neighboring county/city agencies
  - State agencies
  - Federal agencies
  - Area environmental or watershed organizations

Sample Data Sources

- Watershed Coverages:
  - 8-digit: http://water.usgs.gov/GIS/huc.html
  - 14-digit: www.ncgc.nrcs.usda.gov/products/datasets/watershed
  - Check tribal or state agencies for small watershed coverages
- EPA Reach Files
  - I.D. and interconnect the stream reaches all over U.S.
  - 3 versions RF1, RF2, RF3-Alpha (most detailed)
  - www.epa.gov/waterscience/ftp/basins/gis_data/huc/
- Elevation Data
  - USGS: http://edc.usgs.gov/geodata
  - GIS data depot: http://data.geocomm.com
- Land Use/Population
  - USGS: http://edc.usgs.gov/geodata
  - EPA: www.epa.gov/nrlc/nlcd.html
- BLM Management Plans
  - www.blm.gov/planning/plans.html

Other Data Sources

- State 303 (d) lists and TMDL reports
  - www.epa.gov/owow/tmdl
- Point source discharge permits
  - www.epa.gov/enviro/html/pcs/index.html
- Census of Agriculture
  - www.nass.usda.gov/census
- Septic tank use
  - http://quickfacts.census.gov/

Identifying stressors and sources

- Identify specific causes & sources of water quality impairments or threats
  - Examples: metals from abandoned mine lands, sediment & high flows from urban runoff, habitat loss from channelization, etc.
- Quantify or estimate pollutant sources requiring controls
  - Examples: # of feedlots needing upgrades plus rough average of cattle per lot; number of mine sites needing treatment with estimates and general profiles of flows, etc.
  - Can "bundle" stressors and/or sources

Example stressor source estimate (based on review of data, preliminary surveys, habitat assessment, IBIs, chem/phys data)

Table 3-5 shows the percentage of nonpoint pollution sources as estimated from surveys conducted throughout the basin in 1997.

Table 3-5. Percent estimates of pollution sources by category

Cataloging Unit	Silviculture	Development	Mining	Hydro-modification	Row Crops	Animal Husbandry	Other
Mulberry Fork	34	31	1	1	2	31	0
Sipsey Fork	43	21	0	0	1	34	1
Locust Fork	9	21	2	0	6	62	0
Upper Black Warrior	35	45	3	0	1	15	1
Lower Black Warrior	37	24	0	0	2	36	1

Information collected in this project has been used to direct BMP demonstration and implementation within priority watersheds. The assessment methodology developed in the Black Warrior Basin project can also be used to assess water quality in other basins. These methods allow ADEM to estimate trends in ecological conditions by assessing the effectiveness of cumulative management practices implemented within priority watersheds.

Table 11.1 Metal loads from selected adits in the Upper Animas Basin

			Pounds per day											
			High Flow						Low Flow					
Mine	Phase 1 % Removal	Cost $ 1000's	Al	Cd	Cu	Fe	Mn	Zn	Al	Cd	Cu	Fe	Mn	Zn
Cement Creek														
Mogul	80%	1000	1	0.04	1.7	14	4	2	1	0.02	0.7	5	1	3
Silver Ledge	50%	300	25	0.09	0.6	222	33	15	4	0.03	0.0	56	11	3
Grand Mogul	0%	60	15	0.15	5.3	33	10	27	1	0.01	0.2	9	0	1
Mammoth	50%	60	1	0.00	0.0	14	2	8	1	0.00	0.0	16	2	0
Anglo-Saxon	50%	60	0	0.00	0.0	15	10	2	0	0.01	0.0	15	5	1
Joe & Johns	50%	300	0	0.00	0.2	1	1	1	0	0.00	0.0	1	0	0
Big Colorado	50%	300	1	0.00	0.0	3	3	0	1	0.00	0.0	6	0	0
Porcupine	50%	60	0	0.00	0.0	14	5	1	0	0.00	0.0	10	5	1
Evelyn	50%	1000	1	0.00	0.0	2	0	0	2	0.00	0.0	3	0	0
Lewis property	50%	60	0	0.01	0.4	2	0	1	0	0.01	0.4	2	0	1
Total Cement Creek			44	0.29	8.3	320	68	57	10	0.07	1.3	113	25	12
Mineral Creek														
Kohler	50%	60	33	0.36	30.7	321	10	91	28	0.25	28.3	264	8	78
North Star	50%	300	0	0.02	0.1	6	16	4	1	0.02	0.2	6	11	3
Junction Mine	50%	300	13	0.07	2.2	126	3	14	0	0.00	0.1	3	0	0
Bandora Mine	30%	60	0	0.04	0.1	5	4	10	0	0.02	0.0	2	2	4
Upper Bonner	50%	300	1	0.00	0.0	1	1	1	2	0.01	0.0	2	1	1
Ferrocrete Mine	50%	300	2	0.00	0.0	31	5	1	3	0.01	0.0	32	7	1
Paradise	0%	60	28	0.00	0.1	246	20	2	28	0.00	0.1	246	20	2
Brooklyn Mine	30%	300	1	0.01	0.2	8	2	2	1	0.01	0.2	8	2	2
Bonner Mine	50%	300	1	0.01	0.0	1	1	1	2	0.00	0.0	2	1	0
Lower Bonner	30%	300	1	0.00	0.0	1	0	0	2	0.00	0.0	2	1	1

Description of the NPS management measures needed

- Management measures or BMPs should be linked to (or otherwise address) stressors and sources
  - Estimates for pollutant removal rates or general effectiveness should be included
  - Can be based on typical ranges, i.e., percentage removed/treated, reasonable estimates, etc.
- Specify or map areas where BMPs will be used or installed
  - Examples: all abandoned mine sites with dry weather flows; all streambanks along upper reaches; livestock facilities on Willow Run; etc.

http://www.epa.gov/owow/nps/agmm/index.html

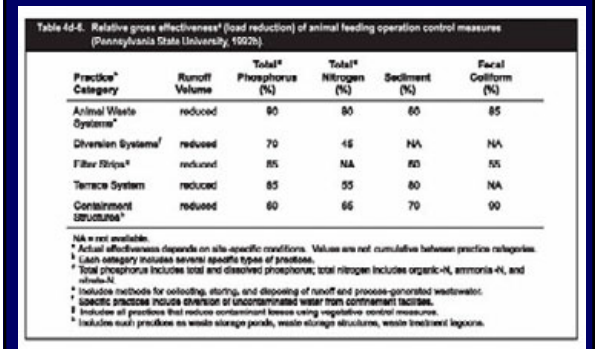


Table 4d-6. Relative gross effectiveness[a] (load reduction) of animal feeding operation control measures (Pennsylvania State University, 1992b).

Practice[b] Category	Runoff Volume	Total[c] Phosphorus (%)	Total[c] Nitrogen (%)	Sediment (%)	Fecal Coliform (%)
Animal Waste Systems[d]	reduced	90	80	85	85
Diversion Systems[e]	reduced	70	15	NA	NA
Filter Strips[f]	reduced	85	NA	80	55
Terrace System	reduced	85	55	80	NA
Containment Structures[g]	reduced	60	65	70	90

NA = not available.
[a] Actual effectiveness depends on site-specific conditions. Values are not cumulative between practice categories.
[b] Each category includes several specific types of practices.
[c] Total phosphorus includes total and dissolved phosphorus; total nitrogen includes organic-N, ammonia-N, and nitrate-N.
[d] Includes methods for collecting, storing, and disposing of runoff and process-generated wastewater.
[e] Specific practices include diversion of uncontaminated water from contaminant facilities.
[f] Includes all practices that reduce contaminant losses using vegetative control measures.
[g] Includes such practices as waste storage ponds, waste storage structures, waste treatment lagoons.

www.epa.gov/owow/nps/forestrymgmt/

Estimating the load reductions expected or needed

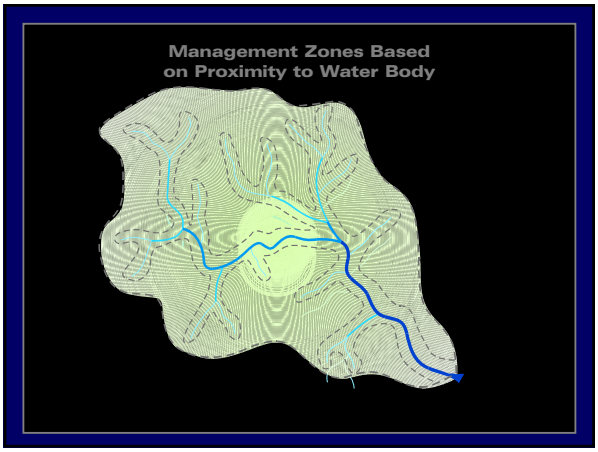
- Calculate the total pollutant load reductions or other benefits expected from the management measures
  - Examples: avg. tons of sediment reduction per day; miles of eroded streambank repaired; lbs of metals trapped per cu ft of waste pile treated; etc.
- If achieving WQ criteria is the goal, estimate initial loadings, calculate reductions needed, and compare to expected reductions
  - Approach can be phased in over time
  - The key success criterion is progress toward goals

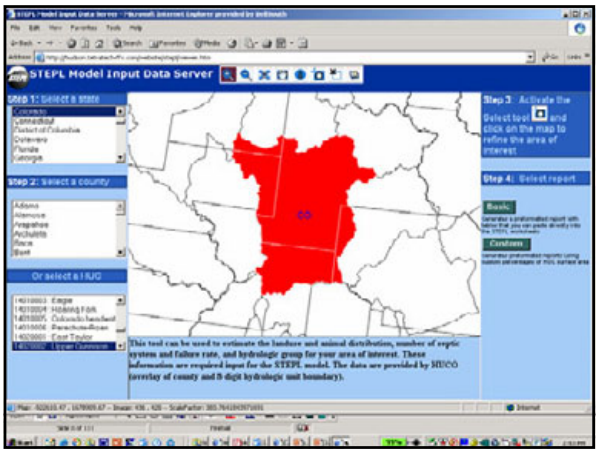
Sample BMP effectiveness table

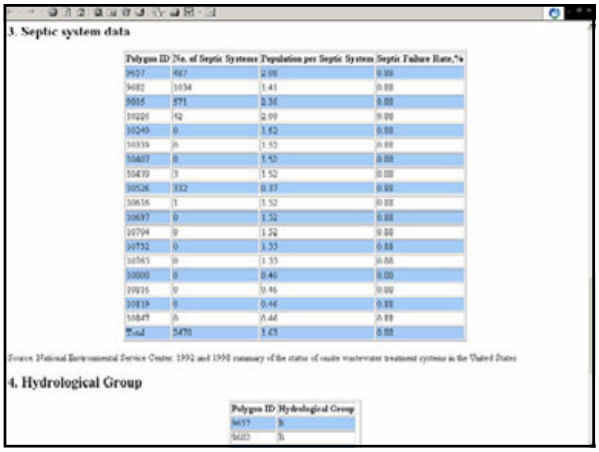
Table 6-3. BMPs and removal efficiencies used in Site Evaluation Tool BMP percent efficiency

BMP	Percent Efficiency			
	TSS	Total Nitrogen	Total Phosphorus	Fecal Coliform
Wet pond	85[d]	33[a]	51[a]	70[a]
Dry detention	47[a]	25[a]	19[a]	78[a]
Stormwater wetland	76[a]	30[a]	49[a]	78[a]
Sand filter	87[a]	32[a]	59[a]	37[a]
Bioretention	87[ij]	53[fgh]	76[fghi]	90[k]
Enhanced Grass swale	93[a]	92[a]	83[a]	- 25[a]
Grass swale	68[a]	20[a]	29[a]	5[a]
Infiltration trench	95[a]	51[a]	70[a]	90[a]
25-ft forest buffer	57[bc]	27[bc]	34[bc]	5[k]
50-ft forest buffer	62[bc]	31[bc]	38[bc]	5[k]
75-ft forest buffer	65[bc]	33[bc]	41[bc]	5[k]
100-ft forest buffer	67[bc]	34[bc]	43[bc]	5[k]
200-ft forest buffer	72[bc]	38[bc]	47[bc]	5[k]

[a] Winer, R. 2000. National Pollutant Removal Performance Database for Stormwater Treatment Practices, 2nd ed. Center for Watershed Protection, Ellicott City, MD.







3. Septic system data

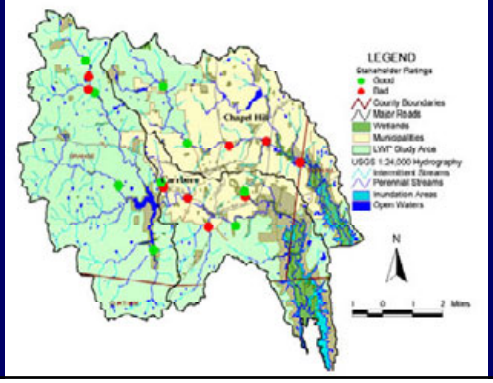
Polygon ID	No. of Septic Systems	Population per Septic System	Septic Failure Rate,%
9657	497	2.09	0.00
9482	1034	1.41	0.00
9805	571	2.56	0.00
10226	42	2.09	0.00
10249	0	1.52	0.00
10339	0	1.52	0.00
10407	0	1.52	0.00
10439	1	1.52	0.00
10526	332	0.37	0.00
10636	1	1.52	0.00
10697	0	1.52	0.00
10704	0	1.52	0.00
10732	0	1.52	0.00
10765	0	1.55	0.00
10800	0	0.46	0.00
10816	0	0.46	0.00
10839	0	0.46	0.00
10847	0	0.46	0.00
Total	5470	1.63	0.00

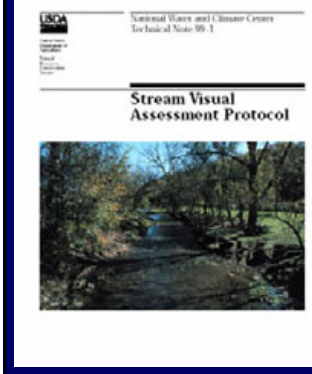
Source: National Environmental Service Center. 1992 and 1998 summary of the status of onsite wastewater treatment systems in the United States

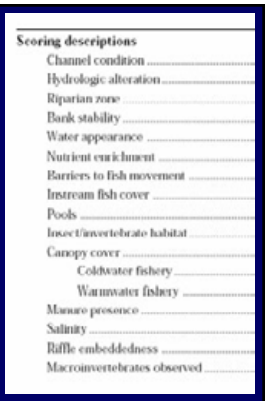
4. Hydrological Group

Polygon ID	Hydrological Group
9657	B
9482	B

Stakeholder Perceptions

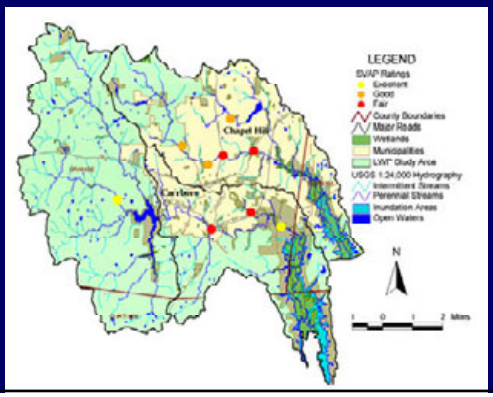






http://www.nrcs.usda.gov/technical/ECS/aquatic/svapfnl.pdf

Stream Visual Assessment



Establish "Big Picture" Management Objectives

Examples

- Restore aquatic habitat by addressing channel instability and sedimentation
- Protect drinking water reservoir from excessive nutrient loads & eutrophication

Establish indicators & targets for management objectives

INDICATOR = measurable quantity used to evaluate relationship between pollutant sources and environmental conditions

TARGET = value of indicator that is set as the goal to achieve

Example linkage

OBJECTIVE = protect drinking water reservoir from excessive eutrophication

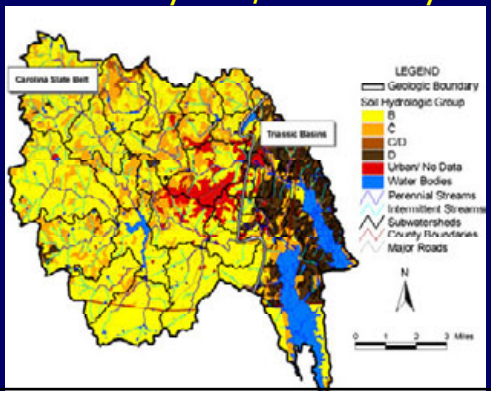
INDICATOR = chlorophyll-*a* as a measure of algal productivity

TARGET = maintain concentration of chlorophyll a $\leq$ 15 μg/L on a seasonal basis near the water supply intake

Develop tools for assessment of indicators

- GIS land cover analysis
- Statistical analysis of new/existing data
- Deterministic modeling
- Field methods

Preliminary GIS/Data Analysis



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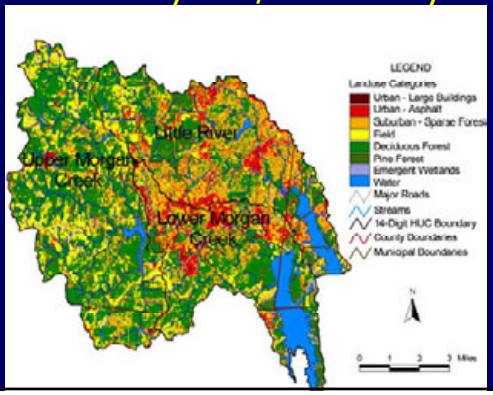

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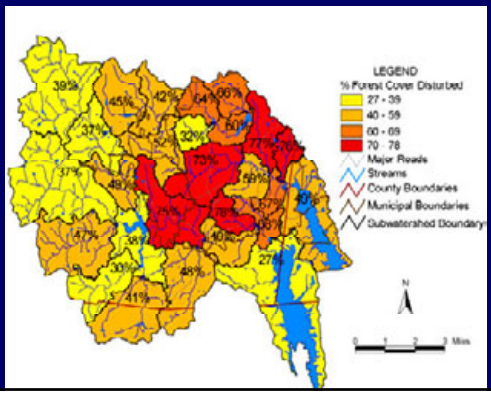

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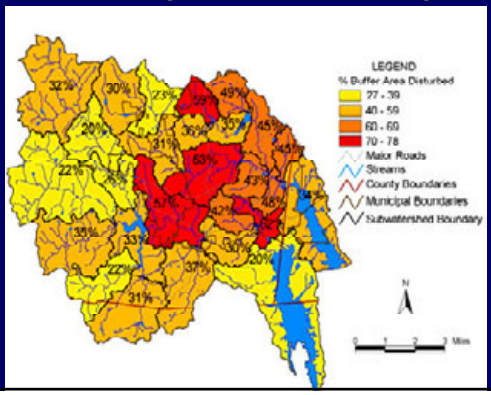


Prioritize management efforts

- Integrate assessment results across objectives
- Example factors to consider
  - Highest threats to achieving objectives
  - Regulatory requirements
  - Where are existing management regulations, programs, policies, practices falling short
  - Stakeholder preferences

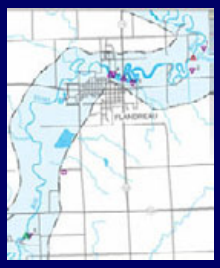
Watershed management plan development

- Identify candidate management options
  - Actions/BMPs that best address problems
  - Screen technical and political feasibility
- Evaluate combinations of options
  - Use predictive modeling and assessment tools to determine effectiveness
  - Analyze other criteria (cost, public support)

Select best options

Describe NPS management measures needed to achieve pollutant reductions

- What is essential to achieving objectives?
- Which options are preferred by stakeholders?
- Which options have greatest chance for long-term success and sustainability?



Develop implementation strategy

- Identify who will do what, how, where, and when
  - BMP type & location
  - Installation/construct. schedule
  - O&M requirements
- Estimate technical and financial resources required
  - source of $$, permits, etc.
- Develop monitoring program to evaluate plan effectiveness

Example Milestones

- Short-term (<1 yr)
  - Achieve 5% reduction in sediment load on 1,000 acres of ag land in the Cross Creek watershed by implementing rotational grazing practices.
- Mid-term (1-4 yrs)
  - Reduce streambank erosion and sediment loading rate by 15% by reestablishing vegetation along 3,600 feet of Cross Creek.
- Long-term (>5 yrs)
  - Install 4 stormwater detention ponds to reduce sedimentation by 50% into Falls lake.

Selecting indicators, targets, and goals

INDICATORS = measurable quantity used to evaluate relationship between pollutant sources and environmental conditions

TARGETS = value of indicator that is set as the goal to achieve

REDUCTION GOALS = values of indicators that must be reduced to achieve targets

Measurable Indicators

- Administrative

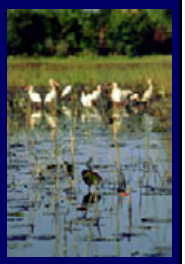
- Social

- Environmental

Programmatic/Administrative Indicators

- # of newspaper stories printed
- # of people educated/trained
- # of public meetings held
- # of volunteers attending activities
- # of storm drains stenciled

Environmental and Social Indicators

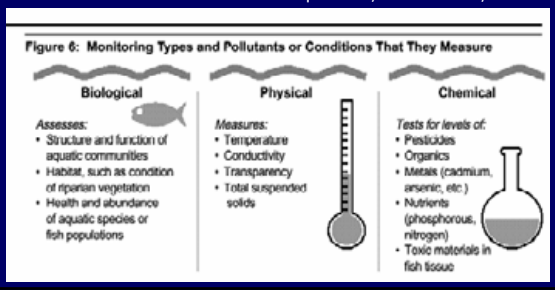


- Environmental Indicators:
  - # of occurrences of algal blooms
  - miles of streambank restored or fenced off
  - % increase in "healthy-stream" critters
  - Increase in DO
  - # of waterbodies restored
- Social Indicators:
  - # of calls reporting illegal dumping
  - # of people surveyed with increased knowledge of watershed issues
  - # of people who report picking up pet waste
  - % increase in households who had their septic tanks inspected

Issue	Suite of Indicators
Eutrophication	▪ P load ▪ # of nuisance algae blooms ▪ Transparency ▪ Frequency of taste and odor problems in water supply ▪ Hypolimnetic DO in a lake/reservoir ▪ Soil test P in agricultural fields
Pathogens (related to recreational use)	▪ Bacteria counts ▪ Compliance with WQS (single sample or geometric mean) ▪ # and duration of beach closings ▪ # of shellfish bed reopenings ▪ Incidence of illness reported during recreation season
Sediment	▪ Suspended sediment concentration and load ▪ Raw water quality at drinking water intake ▪ Frequency and degree of dredging of agricultural ditches, impoundments, water supply intake structures

Water quality criteria: linked to designated uses

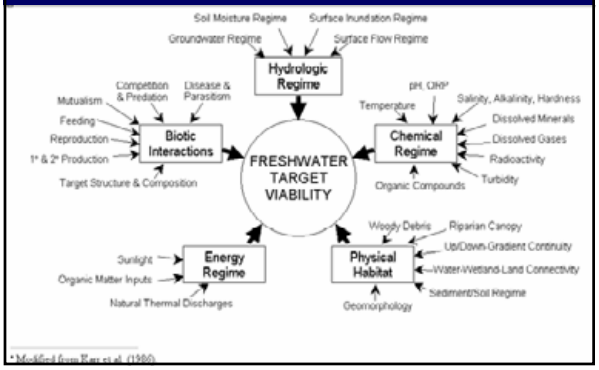
- Basic types of criteria:
  - Narrative, numeric, and biological
  - Water column/sediment/fish tissue
- Categories of criteria:
  - Aquatic life, human health, wildlife



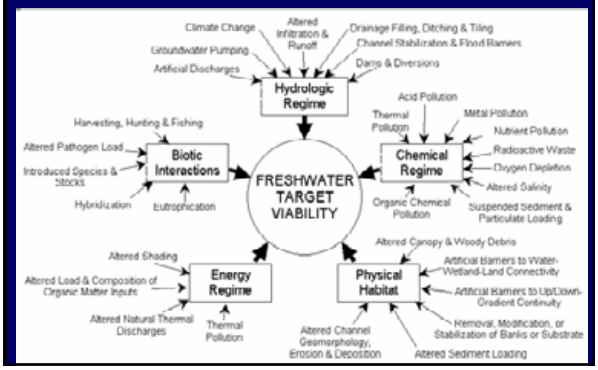
Criteria for measuring water quality improvements

- Revisit the parameter(s) you're trying to impact (sediment, nutrients, etc.)
- Identify measurable criteria associated with the parameter(s)
- Check to see if anyone out there is monitoring your parameters
- If not, develop a low-cost & effective monitoring program
- Be selective! Don't monitor everything!

Measurable attributes of water resource quality



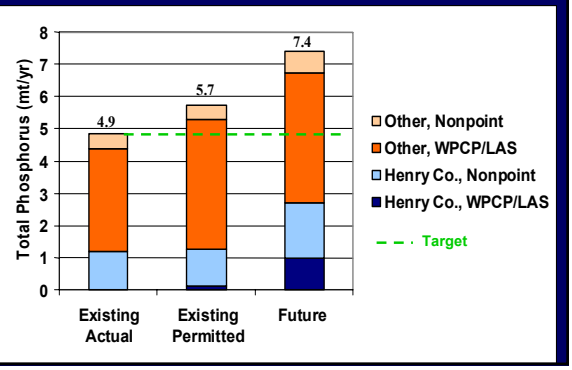
Activities & conditions that impact water resource quality



Select Indicators/ Targets

- Measurable parameters to link pollutant sources to environmental conditions
  - Peak flow
  - Nutrient concentration
  - Temperature
- Specific numeric value set as target for each
  - Based on water quality criteria, reference conditions, etc.

Example: using indicators to set targets



Implementing a monitoring program

- Staffing
- Equipment procurement
- Training
- Field preparation
- Laboratory coordination
- Data and information management

Sampling Protocols

- Standard Methods for field and laboratory analyses
  - Collection
  - Storage
  - Transport
  - Analysis
  - Reporting
- Quality Assurance and Quality Control (QAQC)

The Conservancy's overall water quality monitoring program is based on the following goals and objectives:

GOAL #1: To design and implement a Water Quality Monitoring Program in the Roaring Fork watershed.

Objective 1: Produce an Inventory Report that summarizes water quality monitoring activities in the Roaring Fork watershed.
Objective 2: Identify new sites for monitoring.
Objective 3: Develop a water quality monitoring sample plan.
Objective 4: Establish a data management program.
Objective 5: Partner with existing River Watch monitoring activities and expand River Watch sites.
Objective 6: Establish citizen stream teams.
Objective 7: Establish water quality monitoring at the Roaring Fork Club.
Objective 8: Investigate and evaluate areas of special concern.
Objective 9: Evaluate the program.
Objective 10: Sustain the program over the long term.

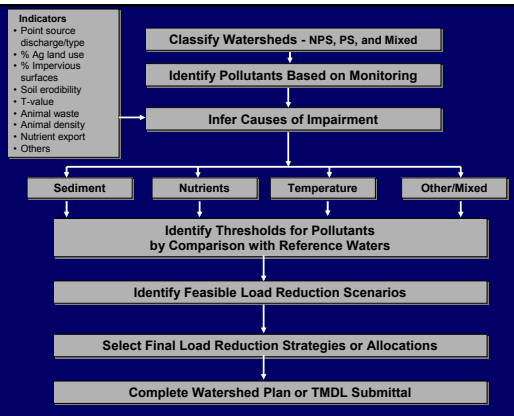
GOAL #2: To provide meaningful water quality information to the citizens and decision-makers of the Roaring Fork watershed.

Objective 1: Form partnerships with other organizations and agencies.
Objective 2: Conduct public presentations to gather feedback and disseminate information.
Objective 3: Publish a State of the River Report.

Finally…Make Adjustments

- Monitor water quality and BMPs
- Compare results to goals
- Are you making progress?
- Are you meeting your goals?
- If you aren't meeting implementation milestones
- If you aren't making progress toward reducing pollutant loads….

- Then…do it all over again!



TMDL Development and Watershed-Based Planning are Similar!

TMDLs and Watershed Plans

Integration is the key!

- If no TMDL exists, develop the watershed plan with estimated load reduction targets
- If there is a TMDL, watershed plan must incorporate load reduction targets in the TMDL
- If TMDL is established after the watershed plan is adopted, it must be amended to incorporate targets specified by the TMDL

Watershed-Based Plans to Protect Unimpaired Waters

- Funding for 319 water resource protection projects is limited
- Projects need to demonstrate that water body is at risk
- Priority is given to high quality waters facing imminent threats
- Existing pollutant loads and load reductions needed are still required

Relationship to Other Key Local, State, and Federal Programs

- Integrating tribal projects with other programs/projects increases success
- Funding priorities for 319 projects favor those with other funding support
- Local and/or state in-kind support can help meet matching requirements
- Federal funding sources (Farm Bill, BLM, US Forest Service, etc.) can improve the project and the chances for success

Table 8-2. Comparison of example parameters in a hypothetical watershed plan and 319 work plan

Parameter	Lake Lehmann Watershed Management Plan	319 Work Plan #1
Period	2003 -2013	2003 - 2006
Geographic scope	160,000 acres	24,000 acres
Goal statement	Improve watershed conditions to support a sustainable fisheries	Reduce sediment loadings from priority subwatershed XY
Example objectives and key elements	• Increase the index of biological integrity from 30 to 75 • Identification of causes and sources of sediment • Identification of load reduction expected • Identification of management practices needed • Identification of critical areas	• Treat 5,000 acres of cropland with crop residue management (CRM) practices • Six terraces to treat 1,200 acres • Five buffer strips established for a total of 8,000 feet
Implementation	• CRM: 2,000 acres of row crop/year into CRM • Terraces: 4 fields/year; 40 fields total • Buffers: restore 1 to 1.5 miles of riparian area/year – 8 miles total • Field buffers: 100 fields total	• Develop training materials on CRM in year 1 • Hold 2 workshop each in years 2 and 3 • 2 terraces/year • 1 buffer strip in first year and 2 each in years 2 and 3
Costs	$4,020,000 over 10 years • $800,000 for information and education (I&E) • $600,000 for monitoring and reporting • $1,980,000 for buffers (18,000 acres at $110 / acre) • $140,000 for 40 terraces • $500,000 for CRM	$260,000 over 3 years • $50,000 to prepare training materials and give 5 workshops on CRM • $160,000 for BMP cost sharing • $40,000 for monitoring and reporting
Schedule	• Begin slowly and accelerate (build on successes) • Establish interim milestones • Cropland: 2006 – reduce soils erosion by 80,000 tons/year	• See above • Annual progress reports

The bottom line (& last word)

- Quantifying pollutants & BMP impacts provides the best management info
- But it's difficult to do . . .
- EPA recognizes the process will be slow, & mid-course corrections will be needed
- Working cooperatively with people (rather than "jurisdictions") helps . . .